

Response
Serial No. 09/926,764
Attorney Docket No. 011474

REMARKS

Claims 6, 8 - 13 are pending. Claims 1 – 5 and 7 are cancelled herein without prejudice. Claim 6 incorporates the limitations of claim 7. Claims 8 and 9 are based on original claims 6 and 7 and page 6, lines 3 – 6 of the specification. Support for claim 10 is found at page 4, line 21 to page 5, line 2. Support for claim 11 is found at page 5, lines 8 – 10. Support for claims 12 and 13 is found at page 5, lines 21 – 25.

Response to Objections

The Office Action objects to the disclosure for various informalities. Applicants have amended all claims and provide in the Response below an explanation in regard to the §112 rejections. Applicants submit the amendments and response below address the issues of the objections as well.

Applicants' Response to the Rejections under 35 U.S.C. §112

Claims 1 and 2 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. The Office Action suggests rewriting the claims. Claims 2, 4 and 5 are rejected under

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35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Claims 1 – 7 are rejected under 35 U.S.C. §112, first paragraph as failing to comply with the enablement requirement. In response thereto, claims 1 – 5 have been cancelled. Applicants' respectfully submit that the rejections thereto are now moot. Claim 6 has been amended to incorporate the limitation of the original claim 7.

The Office Action states that the present invention is “counter to the theoretical basics of magnetism.” Applicants submit that one skilled in the art would be enabled to make and/or use the invention as claimed. When magnetic metal having an unpaired electron (such as Fe, Co, Ni) is added at a low concentration to a metal, even though the metal is non-magnetic, the unpaired electron with localized magnetic ion can cause spin polarization of conducting electrons of the metal. (Spin polarization occurs as a difference in the possibility of finding up-spin and down-spin in a certain space.) This spin polarization is propagated in the metal as a damping oscillation and it gives an indirect exchange interaction to the localized spin of the low-concentration magnetic metal ion in its immediate area, both the localized spin of the low-concentration magnetic metal ion and the localized spin of the magnetic metal ion which first caused spin polarization to align in the same direction. As these interactions propagate in the whole metal material, the localized spin of magnetic ion aligns ferromagnetically. This mechanism is called “RKKY mechanism,” which is well known and written in textbooks in the field. See e.g., Kittel, *Introduction to Solid State Physics*, sixth edition, p. 598.

The present inventors discovered that such spin alignment is caused by π -non-localized organic radical ligand which is chemisorbed on the nonmagnetic gold particles. On the other hand, regarding conjugated organic compounds, a similar phenomenon has been discovered by the present inventors. Where there is a plurality of localized unpaired electrons at certain locations of π -conjugated systems within a certain period, spin alignment takes place due to the propagation of spin polarization through π -conjugated systems (T. Sugawara et al., J. Am. Chem. Soc., 108, 368-371 (1986)). The present invention is based on the discovery that this phenomenon also appears in organic-non-organic composite systems. Hence, one skilled in the art would be enabled based on the disclosures set forth to make and use the claimed invention.

The Office Action also refers specifically to the designation of a Weiss temperature below 0K. Applicants submit that this disclosure is readily understandable to one skilled in the art. Applicants refer to Figure 5 and page 10, lines 9 – 20 of the specification. Fig. 5 has a vertical axis showing a value of multiplying a magnetic susceptibility by a temperature, and a horizontal axis of a temperature. Curie temperature per gram can be obtained by extrapolation of the horizontal line between 300K and 100K toward the vertical axis. The obtained value can be calculated into a spin quantum number per gold minute particle, of about 8. This shows that about 16 pieces of the organic radicals, chemically absorbed to the gold minute particles, combine strongly and ferromagnetically, aligning its spins. Non-reduction at 300K of the value allows the estimation that the strength of the ferromagnetic interaction will be 500K or more.

As shown in Fig. 5, the declining trend at the lower temperature means that a anti-ferromagnetic phase, to a very weak extent, is generated between the spin aligning particles. If it generates a ferromagnetic interaction, the trend will be upward. Therefore, the value, “-2.5K,” is not an error.

In essence, as discussed in the specification, the present invention describes a method for preparing a super-paramagnetic material of a gold nano particle and an organic radical, not that a ferromagnetic metal was made.

Applicants further submit that organic radicals which combine with metal particles are not limited to phenyl nitronyl nitroxide and phenyl nitroxide. These are typical examples provided. The same phenomenon takes place with other organic π -radicals where an unpaired electron occupies the p-orbital and spin polarization propagates to the terminal hetero atom (mainly sulfur atom). Those include phenoxy radicals and verdazyl radicals.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.


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If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Stephen G. Adrian', is written over the printed name.

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